

# THE DISCOVERY OF BATRACHOSPERMALEAN TAXA (RHODOPHYTA) IN AUSTRALIA AND NEW ZEALAND

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## ABSTRACT

Entwisle, Timothy J. The discovery of Batrachospermalean taxa (Rhodophyta) in Australia and New Zealand. *Muelleria* 8(1): 5–16 (1993). — The discovery in Australia and New Zealand of species in the freshwater red-algal order Batrachospermales is chronicled. From 1802 to 1930, almost all taxa discovered were included within European species: names were provided by European specialists or taken from European floras. From 1930 to 1972, the Latvian phycologist Heinrichs Skuja devised 17 new names for Australian and New Zealand taxa, but published only three of these before his death in 1972. Recent decades have seen a return to a more conservative approach, perhaps concealing the richness of the flora.

## INTRODUCTION

Since European settlement in Australia and New Zealand, aquatic habitats have been devastated by frenzied deforestation and land improvement, coupled with an unquenchable thirst for drinking-water and hydroelectricity. The freshwater red algae — in particular the Batrachospermales — generally favour pristine waters, and have declined in abundance and probably in diversity. Despite sporadic collecting over nearly two centuries, the richness and endemism of the freshwater red algal flora in Australia and New Zealand remains uncertain.

While accumulating material for a monograph of the Batrachospermales in Australia and New Zealand, I have encountered many names which are either unpublished, ambiguous or synonyms of earlier names. Many of these names are better understood in their historical context. In the following account, I have combined information from unpublished correspondence, herbarium vouchers and published works. Ducker (1990) provides an excellent introduction to the history of marine phycology in Australia, and her paper should be consulted for further information on Robert Brown, Ronald Gunn, William Harvey, Joseph Hooker, Arthur Lucas, Florence Perrin and William Woolls. Authorities for the species names mentioned can be found in the index and herbarium abbreviations follow Holmgren *et al.* (1981).

### 1800–1864: INCIDENTAL ENCOUNTERS

In 1805, Robert Brown (1773–1858) returned to England with three charophytes and one *Batrachospermum* the only freshwater algae in his Australian booty. The *Batrachospermum*, later numbered 187 in the *Inter Australiense* series, languished for 130 years in the British Museum of Natural History before being examined and identified. Based on its eventual determination (see p. 7), Brown probably collected the alga from the Sydney region.

The first *published* report of *Batrachospermum* from Australia was based on specimens collected in Tasmania by Charles Stuart (1802–77), and appeared in *Plantae Muellerianae* (Sonder 1853) under the name of *Batrachospermum moniliforme*. Tasmania remained the focus of phycological interest in Australia, with William Harvey (1811–66) collating all known collections of *Batrachospermum* from that isle (Harvey 1860, 1863). Ronald C. Gunn (1808–81), ‘the first resident

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Australian botanist' (Ducker 1990), found a *Batrachospermum* at Launceston in 1844, later identified by Harvey as *B. atrum*. In 1855, surgeon-naturalist David Lyall (1817–95) discovered *B. vagum* and Harvey himself made a further collection of *B. moniliforme*. (All but the Stuart collection are held in Australian herbaria: HO, MEL and NSW.)

Elsewhere in Australia, most colonialists were obliterating all aquatic habitat on auriferous earth. Sonder (1880) included in his list of Australian algae only one additional *Batrachospermalean* record, *Lemanea australasica*. This name was based on an overmature population of *Batrachospermum* from Paramatta River, Sydney, collected by Rev. William Woolls (1814–93). The collection (held at MEL) is undated but was possibly collected before Woolls's (1867) *Contribution to the Flora of Australia*, where he described the algae of the Paramatta River at some length.

In 1850, five years before he found *B. vagum* in Tasmania, David Lyall collected the first *Batrachospermum* from New Zealand. Joseph D. Hooker (1817–1911) recorded this collection from the Canterbury Plains as *B. moniliforme* (Hooker 1855). Also in the nineteenth century, the British phycologist Mary P. Merrifield (1804–89; née Watkins) gave the name *B. atrum* to an undated, unsited collection from Zealand (BM). In 1857, British clergyman and cryptogamist, Miles J. Berkeley (1803–89), writing in England, remarked that *B. vagum* from New Zealand was 'not distinguishable from specimens gathered on Snowdon [in Wales]' (Berkeley 1857, p. 138).

#### 1865–1929: LOCAL INTEREST

In the latter part of the nineteenth century, New Zealand and Australia both spawned naturalists with at least a passing interest in freshwater algae.

In Australia, the amateur microscopist Henry Watts (1828–89) included two species of *Batrachospermum* in his 1865 list of freshwater algae from Victoria. *Batrachospermum pulcherrimum* and *B. vagum* were names undoubtedly taken from Hassall's (1845) *History of the British Freshwater Algae* (Entwisle 1990). Watts includes only *B. moniliforme* in his revised list of 1887, commenting that 'the nomenclature of Algae has changed so much since [the 1865 list] that this previous list is now obsolete' (Watts 1887, p. 136). Watts had since gained access to the European specialists Friedrich T. Kützing and C. F. Otto Nordstedt — through the assistance of Ferdinand von Mueller at MEL — and to two new publications on freshwater algae by Cooke (1882–4) and Wood (1872). Apparently, Sirodot's (1884) definitive monograph of *Batrachospermum* in Europe had not reached Australian shores.

In New Zealand, William L. Lindsay (1829–80) reported on the freshwater algae following a visit there in 1861–2 (Lindsay 1867), but for the *Batrachospermales*, he only reiterated Berkeley's note of a decade earlier. William I. Spencer (1832–97) published the only new records of *Batrachospermum* (Spencer 1882) until well into the 1930s. Spencer, an ex-soldier and physician, worked within the same constraints as Henry Watts (e.g. *History of British Freshwater Algae* was his primary source) but without the patronage of European specialists. Even the same suite of names was used: *Batrachospermum moniliforme*, *B. pulcherrimum* and *B. vagum*. An unidentifiable *Batrachospermum* collected by A. Hamilton from Horokiki River (NW of Wellington) was briefly characterized (Spencer 1882).

While New Zealand went through a 50 year hiatus, collecting continued in Australia. Around the turn of the century, Queensland was ably served by the well-loved and hard-working Colonial Botanist, Frederick M. Bailey (1827–1915). Bailey co-ordinated the efforts of team of local collectors, farming off the algal collections to European specialists, then translating and interpreting their subsequent publications in the *Botany Bulletin of the Queensland Department of Agriculture* (e.g. Bailey 1893, 1895).

Martin A.J. Möbius (1859–1946) in Germany examined three collections of *Batrachospermum* (Möbius 1892, 1895), two by T.L. Bancroft, the other by F. Pigram. The Bancroft collection from Stradbroke Island included only male plants and could not be given a species name, but his collection from Burpengary was identified as *B. vagum* var. *flagelliforme*. Pigram's alga was included in *B. dillenii*, but differed from European material of this species (Möbius 1895; Skuja 1970a). Möbius (1895) also mentioned a collection of *B. dillenii* from Carolina Creek (= Cardinia Creek), Victoria, by Charles French (1840–1933). This 1887 collection (MEL, UPS) was considered by Möbius to be more like European *B. dillenii*, but was later (Skuja *in sched.*, c. 1933) identified as belonging to the closely related genus *Sirodotia*, described by Harald Kylin in 1912. Bailey (1913) summarized the Queensland records in his important *Comprehensive Catalogue of Queensland Plants*.

Arthur H.S. Lucas (1853–1936) opened the account for the twentieth century in 1905, with a collection of *Batrachospermum* from the head of Middle Harbour in Sydney. This may have been where Brown collected 100 years earlier — the collections of Brown and Lucas were later given the same manuscript name (see below). In his 1909 presidential address to the Linnaean Society of New South Wales, Lucas recounted Harvey's Tasmanian records, adding the record from Middle Harbour — as *Batrachospermum* sp. from the eastern coast — and *B. moniliforme* from the southern mainland coast. The record of *B. moniliforme* was presumably that of Alfred D. Hardy (1870–1958), a keen naturalist with a freshwater algal bent (see Entwisle 1990), who found this species at Sydenham, 20 km NE of Melbourne (Hardy 1906). In 1918, Lucas made a further unidentifiable collection of *Batrachospermum*, from Dargens Creek, near Clarence in the Blue Mountains (HO, NSW, UPS).

In Tasmania, Leonard Rodway (1853–1936) made four mixed collections of *Batrachospermum* from mountain streams and lakes between 1910 and 1915 (HO, NSW), naming them either *B. moniliforme* or *B. dillenii*. Over a decade later, Florence Perrin (1884–1952; née Dawson) made the next Tasmanian collections, finding two unidentified species in the Cradle Mountain area in 1928 (HO, NSW).

The Australian booty was now a respectable size. *Batrachospermum* was obviously not uncommon in Australian streams and included at least a handful of species. A few European names had been slapped around and that, as far as the locals were concerned, was that. In New Zealand, a few of the same taxa had been found, but there was little interest in collecting.

### 1930–1972: THE SKUJA YEARS

This complacency was soon shattered. The pre-war decade marked the start of a spectacular renaissance in collecting of *Batrachospermum* (particularly in New Zealand), blossoming with the entrance of Heinrichs Skuja onto the Australian and New Zealand stages.

#### AUSTRALIA, 1930–1934:

Professor Heinrichs Skuja (1892–1972) spent much of his life preparing materials for a world monograph of *Batrachospermum*. In the early 1930s, Skuja was working his way through the herbaria of Europe while soliciting *Batrachospermum* material from around the world. Lucas apparently sent duplicates to Skuja in Latvia. In 1931, Skuja annotated his 1913 specimen from Middle Harbour with the manuscript name *B. ulandrium*. Four years later he gave the same name to Robert Brown's 1802–1805 collection in the British Museum of Natural History. The determination of Lucas's Middle Harbour collection from 1905 as *B. capillaceum* is undated, but presumably occurred during Skuja's Latvian period. Lucas sent his Clarence material (collected in 1918) to Latvia in 1934, where Skuja, although determining the herbarium sheets as *B. dillenii*, allied it

with a Falkland Island alga with the manuscript name of *B. nothogae* (see Entwistle 1992). Skuja also annotated a 1915 collection from Middle Harbour as *B. dillenii*.

In 1934, Skuja sent out the 4th, 5th and 6th parts of his *Untersuchungen über die Rhodophyceen des Süßwassers* from the University of Latvia. Part five announced the discovery of *Nothocladus* Skuja, a new genus allied to *Batrachospermum* and *Sirodotia*. *Nothocladus nodosus* was typified by a Watts collection from the Yarra River, Victoria, made in the early 1880s (Skuja gives the year of collection as 1884, but Kützing examined the alga prior to February 1882). Skuja found that a duplicate sent to Berlin (B) was in better condition than material in MEL. At Kew (K), Skuja relocated material of *B. vagum* collected by David Lyall from Cataract River, Launceston, in 1855. Skuja (1934) described this alga as a second species of *Nothocladus*, *N. tasmanicus*.

#### NEW ZEALAND, 1936–1972:

In 1936 (or early 1937), Robert M. Laing (1865–1941), a keen and distinguished amateur phycologist living in Christchurch, sent Skuja a bundle of Batrachospermalean collections from New Zealand (Table 1). Most of the collections were provided by Lucy M. Cranwell (later L.M. Smith), who combed the northern end of the North Island between 1931–1935. Laing also included material collected by himself, by Elizabeth A. Flint and the 1850 collection by David Lyall. Skuja (1937) replied with the exciting news of six *Batrachospermum* taxa, four of them new to him (Table 1); *B. fruticans* was a taxon known to Skuja from the ‘Antarctic region’. David Lyall’s ‘*B. moniliforme*’ from the Canterbury Plain included two new species, both of which were among the collections by Cranwell from the North Island. *Batrachospermum novae-zelandiae* and *B. gallaei* var. *longipilum* were particularly common in the Auckland-Bay of Islands area. These names all appeared in Laing’s 1939 list of New Zealand seaweeds.

Skuja fled Latvia on the eve of the Russian occupation in 1944, taking little more than his microscope in an open boat across the Baltic Sea. In the same year, the 7th to 12th parts of his *Untersuchungen über die Rhodophyceen des Süßwassers* were published in the final volume of *Acta Horti Botanici Universitatis [Latvia]*. Skuja reached Uppsala, Sweden, where he was to spend the rest of his life (Willén 1979). Part eight of his last Latvian publication concerned a new species of *Nothocladus* from New Zealand and a comparison between the genera *Nothocladus* and *Tuomeya*. (In part 7, Skuja described an endophytic red alga in *Nothocladus* which he called *Balbiania meiospora*.) *Nothocladus lindaueri* was based on two 1940 collections from Waitangi River, near Russell, part of the exsiccatae of Victor W. Lindauer (1888–1964; see Cassie 1971 for bibliographic details). Another specimen from Lindauer’s exsiccatae was given the manuscript name *Batrachospermum gallaei* var. *longipilum*. Clearly, Skuja believed the Batrachospermalean flora of Australia and New Zealand to be quite distinct from that of Europe.

Few other Batrachospermalean algae were discovered in New Zealand in the 1940s and early 1950s. Eileen Willa found some in Fern Gully Creek on Stewart Island in 1945–48. While in New Zealand for three months in 1950, Mary A. Pocock (1886–1977), from Rhodes University, South Africa, collected *Batrachospermum* from near Invercargill with F. Malcolm Corkill. She sent Skuja a small, dried specimen collected from snail shells (Table 1). (In later years, Skuja was eager to examine more epihelicidaean material, but none was found; Corkill 1969, Flint 1969.) V.J. Chapman *et al.*’s (1957) list of freshwater algae included records from Laing (1939) and Spencer (1882), with some updates to nomenclature, an additional collection of *Sirodotia suecica* by Professor Chapman made in 1955, and two Lindauer exsiccatae (*Nothocladus lindaueri* and *B. gallaei* var. *longipilum*, both from the Bay of Islands area).

Alan Hirsch, from Ann Arbor in Michigan, USA, collected widely in New Zealand during 1957, forwarding five samples to Skuja (Table 1). Skuja recog-

Table 1. Batrachospermaceae collections from New Zealand sent to H. Skuja

Collector and date sent to Skuja <sup>1</sup>	No. of colls	Brief Locality	Names of <i>Batrachospermum</i> and <i>Sirodotia</i> taxa provided by H. Skuja, and date sent <sup>1,2</sup>
(Laing 1936) D. Lyall	1	Canterbury Plains	(Skuja 1937) <b>B. novae-zelandiae</b> , <b>B. campyloclonum</b>
R. M. Laing	2	Kaipoura & Christchurch	<b>B. gallaei var. longipilum</b> , <i>S. suecica</i>
L. M. Cranwell	8	Bay of Islands & Auckland areas	<i>B. dillenii</i> , <i>B. gallaei</i> var. <i>longipilum</i> , <i>B. novae-zelandiae</i> , <i>B. campyloclonum</i> .
E. A. Flint	5	Cass, Milford Sound & Inchbonnie	<i>S. fennica</i> , <b>B. atrichum</b> , <b>B. fruticans</b> , <i>B. campyloclonum</i>
(Pocock 1950) M. A. Pocock & J.M. Corkill	1	Stewart Island	(Skuja 1950) <i>B. virgato-decaisneanum</i>
(Hirsch 1957) A. Hirsch	5	Waitakaruru & Tawhiti Streams & Cam River	(Skuja 1957) <b>S. ateleia var. australis</b> , <i>B. novae-zelandiae</i> , <b>B. aff. ectocarpoideum</b>
(Flint 1961b) H. D. Gordon	4	Wellington area	(Skuja 1961) <b>?var. australe B. anatinum</b>
C. J. Burrows	3	Esk River & Maruia Springs	<i>B. campyloclonum</i>
N. Leov	1	Cleddau River	<i>B. campyloclonum</i>
E. Flint	3	Cass area	<i>B. campyloclonum</i>
R. Mason	1	Waihopuhopu Creek	<i>S. delicatula</i>
(Flint 1963) K. Wise	1	Auckland Island	(Skuja 1963) <i>B. gallaei</i> var. <i>longipilum</i>
E. C. M. Segar	2	Torbay Falls & Ngarotonga Valley	<b>B. pullum</b> , <b>B. faciferum</b> , <i>B. gallaei</i> var. <i>longipilum</i> , Valley <b>B. sp. nov. (sect. Contorta)</b>
(Flint 1964a) E. Flint	3	Lake Roundabout	(Skuja 1964) <i>S. fennica</i>
(Flint 1965) E. Willa	10	Stewart Island	(Skuja 1965) <b>B. lamprogyne</b> ,
M. Parsons	18 <sup>3</sup>	Wellington & Nelson	<i>B. campyloclonum</i>
V. Stout	3	Westport	<i>B. campyloclonum</i> <b>B. sp. nov. (Waimea Creek)</b> , <i>S. suecica</i> var. <i>australis</i>
(Flint 1969) M. Taylor	6	Oamaru area	(Skuja 1970b, 1970c) <b>B. microspermum</b> , <i>B. gallaei</i> var. <i>longipilum</i> , <i>S. ateleia</i>
(Flint 1972) E. J. Cudby	1	Lake Rotoaira	No reply <sup>4</sup>
F. Hill	15 <sup>5</sup>	Waikato River lakes	
V. Stout	3	Milford Track	
M. Taylor	5	Oamaru area	
F. Michaelis	3	Nelson area	

<sup>1</sup> The author and date of the accompanying letters are given in brackets. Lindauer's exsiccatae is not included here.

<sup>2</sup> Bold type indicates the first record of a new taxon, roman type indicates a new record for New Zealand of an existing name, and italics are used for subsequent records of all taxa. Note that if there is more than one sample in a particular batch of a new taxon or record, the presumed earliest collected is in bold type.

<sup>3</sup> Also including species of *Asterocytis*, *Bostrychia*, *Hildenbrandia* and *Rhodochorton*.

<sup>4</sup> Skuja was unable to examine this last batch and died soon after its arrival.

<sup>5</sup> Also including species of *Audouinella*, *Bostrychia* and *Compsopogon*.

nized two new taxa in these collections (one allied to the North American species *B. ectocarpoideum*), and more of his *B. novae-zelandiae* (Table 1). This marked the beginning of an extremely productive period in the discovery of the *Batrachospermales* in New Zealand. In 1960, Elizabeth Flint took on the role as Skuja's New Zealand correspondent. Flint left Christchurch in the 1930s to study under F.E. Fritsch at Queen Mary College in London, followed by a decade of teaching and further research in England. Since her return to New Zealand in 1955, Flint had worked with the DSIR at Christchurch on the taxonomy and ecology of soil and lake microalgae. Flint replied to an enquiry by Skuja about *Batrachospermum* holdings in New Zealand herbaria with a list from the Auckland Museum supplied by Robert Cooper (Flint 1961a). Meanwhile, Willa had written to Flint promising to collect more *Batrachospermum* from Stewart Island (Willa 1960, 1961).

By mid 1961, Flint had accumulated eleven formalin preserved samples and one dried sheet, the first of six batches she sent to Uppsala (Table 1). Skuja was eager to examine collections from the southern hemisphere, and no wonder. Nearly every batch included previously unknown species, as well as new records for New Zealand (Table 1). Flint provided Skuja with as much habitat information as possible and generally kept him aware of activities in New Zealand. For example, when Skuja identified material from Lake Roundabout, c. 80 km SW of Cass, as *Sirodotia fennica* (Skuja 1964), Flint responded with the information that the original site at Cass was now much modified and *S. fennica* was no longer to be found there (Flint 1964b).

Another phycologist impressed with the diversity of *Batrachospermales* in New Zealand was the idiosyncratic North American, Lewis H. Flint. In 1963, L.H. Flint annotated specimens in Lindauer's herbarium held at the University of Auckland (AKU). Much of the material was collected from the Bay of Islands area by Lindauer, but E. Willa also contributed material from Stewart Island. L.H. Flint identified the following species: *Batrachospermum androgyne*, *B. campyloclonum*, *B. gallaei*, *B. gallaei* var. *longipilum*, *B. islandrinum*, *B. novae-zelandiae*, *Nothocladus lindaueri*, *Sirodotia gardneri* and *S. suecica*. Most of these names (some misspelt by L.H. Flint) were devised by Skuja for New Zealand endemics (Table 1), but *S. gardneri* is a North American species and *B. gallaei* had been reported world-wide. In the same year, James Fox Wilson donated his herbarium to BM, including an undated specimen of *B. atrum* from New Zealand.

To attract new collectors, Elizabeth Flint advertised for freshwater red algal material in the *New Zealand Limnological Society Newsletter* of 1968. She received a favourable return, particularly the steady flow of material from C. Frank Hill, botanist to the New Zealand Department of Electricity in Hamilton (Hill 1969). In March 1972, Flint bundled up 27 samples in her last batch of freshwater red algae and mailed them to Skuja (Table 1).

#### AUSTRALIA, 1945–1972:

Australia's inland waters received little attention in the 1940s, but Professor Skuja still had some input. In 1945, H.B. S. Womersley collected material from Mt Compass, South Australia, which was given the manuscript name *Sirodotia ambigua* by Skuja. Cecil B. Kay (?of the State Electricity Commission of Victoria) collected *Nothocladus nodosus* from Cardinia Creek, near Melbourne, in 1947 (Ducker, pers. comm.; MELU), a sample of which was sent to Skuja for confirmation.

Around 1950, A. D. Hardy found *Batrachospermum moniliforme* in a few of the creeks and reservoir outflows near Melbourne (Hardy 1931–56). Hardy also reported the North American genus *Tuomeya* from Silver Creek, but this was presumably a misidentification of one of the common *Batrachospermum* or *Nothocladus* species found in the Yarra River basin (Entwisle 1989a). In New South Wales, *Batrachospermum* was reported to be common in the Blue Mountains and in National Park near Sydney (McLuckie & McKee 1954).

Just after Christmas 1960, David H. Ashton, a plant ecologist at the University of Melbourne, collected an intriguing alga from the Arthur Range in south-west Tasmania. It was identified as *Lemanea* sp. by his colleague Sophie C. Ducker and remarkably (for such a fascinating record of this genus) filed and forgotten in the University of Melbourne Herbarium (MELU). It has been included recently in an endemic Australian genus allied to *Lemanea* (see following page).

In 1965, Valerie May summarized the state of knowledge in Australia, listing Harvey's three *Batrachospermum* species and the two new *Nothocladus* species in her census and key to the red algae of Australia (May 1965). *Batrachospermum* was still being collected, but the same few names were being used. As her census was being published, Valerie May found an alga in the Flinders Ranges, South Australia, which she identified as *B. atrum*. In 1966, V.H. Jolly & M.A. Chapman reported an unnamed species from Coxs River, New South Wales. Further north, Alan B. Cribb included *Batrachospermum* as part of his extensive freshwater algal collecting in Queensland. Between 1962 and 1986, Cribb made some 30 collections of *Batrachospermaceae*, all but one from Queensland (the other from Tasmania), and mostly identified as *Batrachospermum* sp. (BRI). A few other Queenslanders were inspired to collect for Cribb during this period.

As in New Zealand, the 1960s marked a revival in interest in the *Batrachospermales*. In 1966, Peter A. Tyler of the University of Tasmania collected *Batrachospermum* from the pristine streams and lakes of southern Tasmania. In 1968, Tyler, a specialist in the taxonomy of microalgae, sent his *Batrachospermum* collections to Skuja. Skuja excitedly reported back that Tyler had rediscovered *B. nothogaeae*, in material from Lake Pedder (see Entwisle 1992). Skuja also identified *B. vagum* and *B. gallaei* var. *longipilum* in Tyler's collections, noting that Möbius's (1895) record of *B. dillenii* from Queensland was neither *B. dillenii* nor his own *B. gallaei* var. *longipilum*.

It was *Batrachospermum nothogaeae* that excited Skuja. Tyler tried unsuccessfully to collect more of this taxon later in that year (from the nearby Lake Maria complex), in 1969 (from North Lake in the Mt Picton area) and in 1970 (from a creek flowing into Lake Pedder). All collections were referable to Skuja's *B. gallaei* var. *longipilum* — interesting but not captivating! Finally, at the insistence of Skuja, Tyler sent the remainder of his original 1966 collection to Uppsala in March, 1972 (Entwisle 1992). Coincidentally, it was in the same month that Elizabeth Flint in New Zealand mailed off her last batch to Skuja.

#### EPITAPH:

Neither Tyler in Australia nor Flint in New Zealand heard further from Skuja. In 1970, he suffered a stroke from which he never fully recovered, and died on the nineteenth of July, 1972 (Thomasson 1974). At the same time in Tasmania, 'waters impounded behind a dam built by the Hydro Electric Commission of Tasmania. . . merged with those of Lake Pedder', leading to the submergence and destruction of 'one of the most beautiful, if not the most beautiful lake in Australia' (Bayly & Williams 1973). Tyler's collection from the beach of Lake Pedder became irreplaceable.

#### 1973–1992: AFTER THE FLOOD

Part of Lake Pedder's precious algal cargo at least has been resurrected. The 1972 samples of Flint and Tyler, still in their packaging, were sent from UPS to MEL in 1981. Last year, the centenary of Skuja's birth, *B. diatyches* was described for an apparently uncommon *Batrachospermum* from Tasmanian mountain lakes (Entwisle 1992).

In the twenty years since Skuja's death, some progress has been made in the discovery and classification of the *Batrachospermales* in Australia. Of note is the

establishment *Psilosiphon scoparium*, a new genus and species of Lemnaceae. In 1984, Adrienne Harding and Brian Gunning, plant physiologists at the Australian National University, discovered this *Lemanea*-like plant at Barren Grounds, c. 100 km SSW of Sydney. The Tasmanian '*Lemanea*' collected by D.H. Ashton in 1960 also belongs to this species (Entwisle 1989b).

An introductory account of the freshwater red algae of south-eastern Australia was published in 1984 (Entwisle & Kraft 1984), followed by some further refinement to their classification in 1989 (Entwisle 1989a). Names included in these two publications and not previously reported from Australia were: *Batrachospermum ectocarpum* (as *B. boryanum* in 1989), *B. helminthoideum* (as *B. gelatinosum* in 1989), *B. keratophyllum* and *B. virgato-decaisneum*. In the same period, a few more or less incidental records were published, but no new names used (e.g. Chessman 1982, Cribb 1987, Ling & Tyler 1986). A number of nomenclatural changes resulted from Necchi & Entwisle's (1990) subsumption of all species of *Nothocladus*, *Sirodotia* and the North American *Tuomeya* into the genus *Batrachospermum*.

In New Zealand, the death of Skuja marked the end of a brief but fruitful (in collecting terms at least) revival. Aside from a brief note recounting the loss, and rediscovery in 1964 of *Sirodotia fennica* near Cass (Flint 1977, *vide* Cassie 1984), Flint's 1966 paper is the most recent record of *Batrachospermales* included in Vivienne Cassie's (1984) *Revised Checklist of the Freshwater Algae of New Zealand*.

The distinctiveness or otherwise of the Australian and New Zealand *Batrachospermales* flora is under review. My own approach in the 1980s was to accommodate as far as possible the southern hemisphere taxa within existing European species. This seemed a practical solution when faced with the uncertain application of existing names, coupled with widely varying species concepts (due primarily to a lack of understanding of phenotypic variability). Skuja obviously followed a different path, circumscribing his taxa far more narrowly. Now, with access to a wide range of Australian and New Zealand material, as well as to northern hemisphere types and other vouchers, a more considered approach should be possible.

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#### REFERENCES

- Bailey, F. M. (1893). 'Contributions to the Queensland Flora. Queensland Freshwater Algae'. [Qd Dep. agric. Bull. No. 20 (Bot. Bull. No. 6): Brisbane.]  
 Bailey, F. M. (1895). 'Contributions to the Queensland Flora. Queensland Freshwater Algae'. [Qd Dep. agric. (Bot. Bull. No. 11): Brisbane.]  
 Bailey, F. M. (1913). 'Comprehensive Catalogue of Queensland Plants, both Indigenous and Naturalised. 2nd Ed'. (A. J. Cumming, Qd Gov.: Brisbane.)



- Bayly, I. A. E. & Williams, W. D. (1973). 'Inland Waters and their Ecology'. (Longman: Camberwell, Australia.)
- Berkeley, M. J. (1857). 'Introduction to Cryptogamic Botany'. (H. Bailliere, London.)
- Cassie, V. (1971). Contributions of Victor Lindauer (1888–1964) to New Zealand phycology. *J. Roy. Soc. New Zealand* 1: 89–98.
- Cassie, V. (1984). 'Revised Checklist of the Freshwater Algae of New Zealand (Excluding Diatoms and Charophytes). Part II'. (Water and Soil Publication No. 26, National Water and Soil Conservation Organization: Wellington.)
- Chapman, V. J., Thompson, R. H. & Segar, E. C. M. (1957). Check list of the fresh-water algae of New Zealand. *Trans. R. Soc. New Zealand* 84: 695–747.
- Chessman, B. C. (1982). 'Latrobe Valley Water Resources Biological Studies, Vol. 3. Algal and Functional Ecology'. (Latrobe Valley Water and Sewerage Board: Traralgon.)
- Compère, P. (1991). Taxonomic and nomenclatural notes on some taxa of the genus *Batrachospermum* (Rhodophyceae). *Belg. J. Bot.* 124: 21–26.
- Cooke, M. C. (1882–4). 'British Fresh-water Algae. 2 vols' (Williams & Norgate, Edinburgh.)
- Corkill, J. M. (1969). *In litt.* to E. A. Flint, University of Canterbury, 16.vi.1969.
- Cribb, A. B. (1987). Some freshwater algae from the Jardine River area. *Queensland Nat.* 28: 69–71.
- Ducker, S.C. (1990). History of Australian marine phycology. In 'Biology of Marine Plants', Clayton, M.N. & King, R.J., eds: 415–430. (Longman Cheshire: Melbourne.)
- Entwisle, T. J. (1989a). Macroalgae in the Yarra River basin: flora and distribution. *Proc. Roy. Soc. Vict.* 101: 1–76.
- Entwisle, T. J. (1989b). *Psilosiphon scoparium* gen. et sp. nov. (Lemaneaceae), a new red alga from south-eastern Australian streams. *Phycologia* 28: 469–475.
- Entwisle, T. J. (1990). The lean legacy of freshwater phycology in Victoria. In 'Development of Systematic Botany in Australasia. Proceedings of the Botanical History Symposium', Short, P. S. ed.: 239–246. (Australian Systematic Botany Society: Melbourne.)
- Entwisle, T. J. (1992). The setaceous species of *Batrachospermum* (Rhodophyta): a re-evaluation of *B. atrum* (Hudson) Harvey and *B. puiggarianum* Grunow including the description of *B. diatyches* sp. nov. from Tasmania, Australia. *Muelleria* 7: 425–445.
- Entwisle, T. J. & Kraft, G. T. (1984). Survey of freshwater red algae (Rhodophyta) of South-eastern Australia. *Aust. J. mar. freshw. Res.* 35: 213–59.
- Flint, E. A. (1961a). *In litt.* to H. Skuja, University of Uppsala, 21.i.1961
- Flint, E. A. (1961b). *In litt.* to H. Skuja, University of Uppsala, 11.vi.1961.
- Flint, E. A. (1963). *In litt.* to H. Skuja, University of Uppsala, 11.iii.1963.
- Flint, E. A. (1964a). *In litt.* to H. Skuja, University of Uppsala, 10.iii.1964.
- Flint, E. A. (1964b). *In litt.* to H. Skuja, University of Uppsala, 23.vi.1964.
- Flint, E. A. (1965). *In litt.* to H. Skuja, University of Uppsala, 12.vi.1965.
- Flint, E. A. (1966). Additions to the check list of freshwater algae in New Zealand. *Trans. Roy. Soc. New Zealand* 3: 123–137.
- Flint, E. A. (1969). *In litt.* to H. Skuja, University of Uppsala, 16.vi.1969.
- Hardy, A. D. (1906). The fresh-water algae of Victoria. Part III. *Victorian Nat.* 23: 18–22, 33–42.
- Hardy, A. D. (1931–56). Unpublished, half-yearly (1931–1942) and Quarterly (1943–1956) Algological Reports by Honorary Algologist, Melbourne and Metropolitan Quarantine Board of Works [now Melbourne Water].
- Harvey, W. H. (1860). Algae. In 'Flora of Tasmania. Vol. 2. Monocotyledons and Acotyledons', Hooker, J. D.: 282–343, pl. 185–196 (L. Reeve: London.)
- Harvey, W. H. (1863). 'Phycologia Australasica. Vol. 5'. (L. Reeve: London.)
- Hill, C. F. (1969). *In litt.* to E. A. Flint, University of Canterbury, 24.vii.1969, 21.x.1969, 11.xi.1969, 18.xi.1969, 25.xi.1969.
- Hirsch, A. (1957). *In litt.* to H. Skuja, University of Uppsala, *vide* Skuja (1957).
- Holmgren, P. K., Keuken, W. & Schofield, E. K. (1981). 'Index Herbariorum. Part 1. The Herbaria of the World. 7th Edition'. (Bohn, Scheltema & Holkema: Utrecht.) [*Regnum Vegetabile* Vol. 106.]
- Hooker, J. D. (1855). 'The Botany of the Antarctic Voyage. . . II. Flora Novae-Zelandiae. Part II. Flowerless Plants'. (Lovell Reeve: London.)
- Kylin, H. (1912). Studien über die schwedischen Arten der Gattung *Batrachospermum* Roth and *Sirodotia* nov. gen. *Nova Acta R. Soc. Scient. upsal.* Ser. IV 3: 1–40.
- Laing, R. M. (1936/37). *In litt.* to H. Skuja, University of Uppsala, *vide* Skuja (1937).
- Laing, R. M. (1939). New Zealand Seaweeds. Reference list no. II. The Rhodophyceae — Part A (Bangiales, Nemaionales, Cryptonemiales, and Gigartinales). *Trans. Proc. Roy. Soc. New Zealand* 69: 134–164.
- Lindsay, W. L. (1867). Addenda to the cryptogamic flora of New Zealand. *Trans. Proc. Roy. Soc. Edinburgh* 9: 201–202.
- Ling, H. U. & Tyler, P. (1986). 'A Limnological survey of the Magela Creek System, Alligator Rivers Region, Northern Territory Algae of the Region (excluding diatoms)'. (Australian Publishing Service: Canberra.)
- Lucas, A. H. S. (1909). Presidential address, including revised list of Fucoideae and Florideae of Australia. *Proc. Linn. Soc. N.S. W.* 34: 1–61.
- McLuckie, J. & McKee, H. S. (1954). 'Australian and New Zealand Botany'. (Horwitz-Grahame: Sydney.)

- May, V. (1965). A census and key to the species of Rhodophyceae (Red Algae) recorded from Australia. *Contr. N.S. W. Nat. Herb.* 3: 349–429.
- Möbius, M. (1892). Australische Süßwasseralgeln. *Flora, Jena* 75: 421–450.
- Möbius, M. (1895). Australische Süßwasseralgeln. II. *Abh. senckenb. naturforsch. Ges.* 18: 309–350, pl. 1–2.
- Necchi, O. Jr & Entwisle, T. J. (1990). A reappraisal of generic and subgeneric classification in the Batrachospermaceae (Rhodophyta). *Phycologia* 29: 478–488.
- Pocock, M. A. (1950). *In litt.* to H. Skuja, University of Uppsala, *vide* Corkill (1969).
- Sirodot, S. (1884). 'Les Batrachospermes Organisation Fonctions, Développement, Classification'. (Librairie de l'Académie de Médecine: Paris.)
- Skuja, H. (1934). Untersuchungen über die Rhodophyceen des Süßwassers. 5. *Nothocladus* ein neue Gattung der Batrachospermaceen. *Beih. bot. Zbl.* 52B: 179–188.
- Skuja, H. (1937). *In litt.* to R. M. Laing, Christchurch, 31.iii.1937.
- Skuja, H. (1944). Untersuchungen über die Rhodophyceen des Süßwassers. 8. *Nothocladus lindaueri* nov. sp. nebst einigen Bemerkungen über die Gattungen *Nothocladus* Skuja and *Tuomeya* Harvey. *Act. Horti. bot. Univ. Latv.* 14: 11–27, pl. 2–4.
- Skuja, H. (1950). *In litt.* to M.A. Pocock, *vide* Corkill (1969).
- Skuja, H. (1957). Unpublished note, University of Uppsala [undated but circumstantial evidence suggests 1957 or 1958].
- Skuja, H. (1961). *In litt.* to E. A. Flint, University of Canterbury, 27.vii.1961.
- Skuja, H. (1963). *In litt.* to E. A. Flint, University of Canterbury, 21.iii.1963.
- Skuja, H. (1964). *In litt.* to E. A. Flint, University of Canterbury, 17.iii.1964.
- Skuja, H. (1965). *In litt.* to E. A. Flint, University of Canterbury, 8.ix.1965.
- Skuja, H. (1970a). *In litt.* to P. Tyler, University of Tasmania, 19.ii.1970.
- Skuja, H. (1970b). Unpublished note, University of Uppsala.
- Skuja, H. (1970c). *In litt.* to F. A. Flint, University of Canterbury, 6.iii.1970.
- Sonder, O. G. (1853). *Plantae Muellerianae, Algae. Linnæa* 25: 657–709.
- Sonder, O. G. (1880). *Algae Australianae hactenus cognitae. In 'Fragmenta Phytographie Australiae, I. Suppl. ad Vol. II', Mueller, F.: 1–42 (Government Printer: Melbourne.)*
- Spencer, W. I. (1882). Notes on fresh-water algae. *Trans. Proc. N. Z. Inst.* 15: 302–304, pl. 26, 27.
- Stearn, W. T. (1973). 'Botanical Latin. 2nd Ed'. (Fitzhenry & Whiteside: Ontario.)
- Thomasson, K. (1974). Prof. Heinrichs Skuja (1892–1972). *Revue algol. N.S.* 9: 3–7.
- Watts, H. (1865). On the freshwater algae of Victoria. *Trans. Proc. R. Soc. Vict.* 6: 67–68.
- Watts, H. (1887). Some recent additions to our knowledge of microscopic natural history. *Victorian Nat.* 3: 133–137.
- Willa, E. (1960). *In litt.* to E. A. Flint, University of Canterbury, 28.xii.1960.
- Willa, E. (1961). *In litt.* to E. A. Flint, University of Canterbury, 23.vii.1961.
- Willén, T. (1979). Heinrichs Skuja and his work. *Acta Bot. fenn.* 110: 5–10.
- Wood, H. C. (1872). A contribution to the history of fresh-water algae. *Smithson. Contr. Knowl.* 19: viii–262, pl. 1–21.
- Woolfs W. R. (1867). 'A Contribution to the Flora of Australia'. (F. White: Sydney).

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Only nomenclatural and published taxonomic synonyms are given (abbreviations follow Stearn 1983, p. 367–72); a full taxonomic synonymy based on examination of types (where available) will be included in the forthcoming monograph. The conclusions of Compère (1991) are accepted here.

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<sup>1</sup> Although the latter name appears in Skuja's manuscripts two years after Flint's herbarium determinations.

<sup>2</sup> In an unpublished note at the University of Uppsala, Skuja annotates a drawing of *B. ectocarpoideum* with '?*B. boryanum* × *B. moniliforme*'. The drawing is based on a specimen sent to Skuja by L.H. Flint on 30.xi.1948.

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